ATTACHMENT A

REMARKS

By the present amendment, a minor wording change has been made to Claim 1 to reflect the intended meaning of this claim. In light of the present amendments, Claims 1-16 are pending in the present application, with claims 1-5, 8-10 and 13-16 rejected on prior art grounds, claims 6, 7, 11 and 12 objected to as being dependent on rejected base claims and claims 14 and 15 withdrawn from consideration. Applicants respectfully traverse the rejection to the claims based on the discussion which follows.

Claims 1-5, 8-10, 13 and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Jimbo et al (JP 49-95952; hereinafter "Jimbo") which Applicants believe is Japanese Patent Application No. 47-95952/JP-A-49-52799 which Applicants submitted in an Information Disclosure Statement on November 7, 2003. The Examiner alleges that Jimbo discloses a method and etchant composition using a solution comprised of 5-10 wt% $NH_4F \cdot HF$ in acetic acid. The Examiner does admit that Jimbo fails to disclose the claimed specific wet etching of BPSG at the claimed rate as thermal SiO_2 and the claimed wet etch processing parameters. However, the Examiner alleges that it would have been obvious to use the wet etching taught by Jimbo to wet etch BPSG at approximately the same rate as thermal SiO_2 alleging that it is conventional or at least well known in the semiconductor fabrication art to etch BPSG layer on a wafer at substantially the same rate as thermal SiO_2.

Contrary to the Examiner's allegation, Jimbo fails to teach or suggest the claimed etching solution which is chemically distinct from the solution of Jimbo and includes chemical properties not taught or suggested by Jimbo. Further, Jimbo fails to teach or

suggest optimizing its composition to have the claimed etching processing parameter properties.

The present invention, as recited in claim 1, is directed to an etching solution having a thermal oxide film (THOX) etch rate and BPSG film etch rate at 25°C of 100Å/min and a ratio of BPSG etch rate/THOX etch rate of 1.5 or lower using a solution which comprises either a fluoride salt or a hydrogen fluoride salt and an organic acid.

In sharp contrast to the present invention, Jimbo discloses an etch solution with properties which fall substantially outside the claimed parameters. Moreover, based on the entire Jimbo disclosure, there fails to be any teaching or suggestion for modifying its solution to have the claimed parameters let alone a hint of how to modify its solution to make the claimed etch solution.

Although the Examiner alleges that it is generally known to etch THOX and BPSG at similar rates, the claimed actual rate range is not. Thus, as shown in the present specification, example 11 which has nearly identical THOX and BPSG etching rates fails outside the product claimed rates of 100Å/min or less. See specifically table 6 of the present specification, comparative example 11 has the following data:

NH4F concentration	:	3.7%
THOX etch rate (Å/min)	:	104
BPSG etch rate (Å/min)	:	101
Selectivity	:	0.97

In comparative example 11, etch rate of THOX and BPSG are almost the same (selectivity = 0.97). However, etch rate of both THOX and BPSG are slightly higher than 100 Å/min. Therefore, comparative example 11 is outside of the invention.

Similarly, although the prior art which may teach etch solutions having similar THOX and BPSG rates, the prior art fails to anticipate the claimed etching rate 100 Å/min or less.

Moreover, the claimed THOX and BPSG etch rates of 100 Å/min or less, is not obvious in view of Jimbo. Contrary to the Examiner's allegation that the claimed parameters would not "necessitate any undo experimentation which would be indicative of a showing of unexpected results", the presently claimed solution has unexpected properties, namely the claimed 100 Å/min or less etch rate, which results from the inventive optimization, disclosed in the present specification, which is completely absent in the prior art. Although the prior art includes numerous examples, none of the prior art examples have the claimed etch rates. Further, the present specification discloses further etching solutions which have the claimed constituents but fail to have the claimed etch rates. Therefore merely disclosing an etch solution which includes the claimed constituents does not teach or suggest an etching solution of the invention which satisfy the following two conditions:

(i) a thermal oxide (THOX) film etch rate and boron phosphosilicate glass (BPSG) film etch rate at 25°C of 100 Å/min or lower; and

(ii) a ratio of (BPSG etch rate) / (THOX etch rate) of 1.5 or lower.

Further, the number of prior art etch solutions, many which include some of the constituents of the present invention, but none of which have the claimed properties, provides evidence supporting the fact that the present invention is not easily prepared without undo experimentation.

Jimbo fails to teach or suggest an etch solution which has the claimed etch rate and 25°C. For example, as shown in the English translation of Jimbo on page 7, lines 8-9, "For practical purposes, the etching rate for all of the films must be 10 to 100 Å/sec. Therefore, when a 10% $NH_4F \cdot HF$ acetic acid solution is used, the etching must be performed at a temperature of about 64°C." The etching rate "10 to 100 Å/sec" is equal to 600 to 6,000 Å/min. Therefore, in Jimbo, a very high etch rate (600 to 6,000 Å/min) is used, which is different from the invention concerning a slower etch rate (less than 100 Å/min).

In addition, Table 1 of Jimbo is the following, in which:

(i) etch rate is represented by Å/min in place of Å/s

(ii) in the lower part of the table, etching selectivity is shown.

Table 1

		Temp °C	Etch rate (Å/min)		
			SiO_2	(As,P)DO	BDO
Reference Example	30% NH_4F aqueous solution		1572	3900	1128
	10% $NH_4F \cdot HF$/acetic acid solution containing 2% water	55	1380	12000	606
Example	10% $NH_4F \cdot HF$ acetic acid solution	55	942	1704	372
	The same as above	64	2358	3264	732
	5% $NH_4F \cdot HF$ acetic acid solution	64	942	2064	648
	The same as above	79	1770	3672	1218

		Temp °C	Etch rate (Å/min)		
			SiO_2	(As,P)DO	BDO
Reference Example	30% NH_4F aqueous solution		1.00	2.48	0.72
	10% $NH_4F \cdot HF$/acetic acid solution containing 2% water	55	1.00	8.70	0.44
Example	10% $NH_4F \cdot HF$ acetic acid solution	55	1.00	1.81	0.39
	The same as above	64	1.00	1.38	0.31
	5% $NH_4F \cdot HF$ acetic acid solution	64	1.00	2.19	0.69
	The same as above	79	1.00	2.07	0.69

As shown in the above table, an etch rate of 10% $NH_4F \cdot HF$ acetic acid solution to (As,P)DO is reduced from 3264 Å/min to 1704 Å/min, as temperature is lowered from 64°C to 55°C. If the etch rate is reduced at the same rate as above as the temperature is lowered, the etch rate of 10% $NH_4F \cdot HF$ acetic acid solution is obviously more than 100 Å/min at 25°C.

With respect to 5% $NH_4F \cdot HF$ acetic acid solution, the etch rate of SiO_2, (AS,P)DO and BDO maintains more than 50% of the initial etch rate (at 79°C) as temperature is lowered from 79°C to 64°C. If the etch rate is decreased at the same rate as above when the temperature is decreased, the etch rate of 5% $NH_4F \cdot HF$ acetic acid solution is obviously more than 100 Å/min at 25°C.

Further, as shown in the table, the etch rate selectivity between SiO_2 and (As,P)DO increases as the temperature decreases. For example, 10% $NH_4F \cdot HF$ acetic acid solution has a selectivity of 1.38 at 64°C and 1.81 at 55°C, and also 5% $NH_4F \cdot HF$ acetic acid solution has a selectivity of 2.07 at 79°C and 2.19 at 64°C.

With respect to NH_4F content, the results of example 4 of table 2, examples 16-19 and comparative example 11 of table 3 of the present specification indicates that 0.2775% to 1.85% of NH_4F containing etching solution will have an etch rate of much lower than 100 Å/min, but 3.7% NH_4F containing etching solution (comp. ex. 11) has an etch rate of higher than 100 Å/min.

With respect to $NH_4F \cdot HF$ content, the results of example 1 of table 1, examples 9-13 and comparative example 8 of table 4 of the specification indicate that 0.1425% to 2.28% of $NH_4F \cdot HF$ containing etching solution will have an etch rate of

about 20 Å/min (0.1425%) and more than 50 Å/min (2.28%). Further considering example 5 in table 2 of the specification, $NH_4F \cdot HF$ containing etching solution will have a higher etch rate.

As shown in the English translation of Jimbo on page 5, lines 13-14, "When NH_4F or $NH_4F \cdot HF$ is used, a strongly acidic solvent in which the salt is dissolved at a fairly high concentration is best suited." As shown above, higher concentrations of NH_4F or $NH_4F \cdot HF$ will result in higher than 100 Å/min of etch rate.

In view of the foregoing, Applicants respectfully submit that claims 1-5, 8-10, 13 and 16 are not obvious in view of Jimbo.

Applicants gratefully appreciate the Examiner's indication of allowable subject matter of claims 6, 7, 11 and 12. Based on the foregoing, Applicants respectfully submit that all pending claims are in a condition for immediate allowance.

END OF REMARKS